

VV&A Resources Management System of Guidance Simulation

Zhenjun Li and Peng Jiao

National University of Defense Technology, Changsha 410073, China

Abstract. In order to heighten the automation degree of VV&A and the security of resource information, the effective management of VV&A resource is needed. In this paper, we firstly analyze the basic flow of lifecycle VV&A of guidance simulation system (GSS) and the related resources during every phase of VV&A. And then the model of VV&A resource will be established. In order to get effective management of VV&A resource, database of VV&A resource is developed based upon Oracle 10g DBMS. Finally VV&A resource management system is designed and realized.

Keywords: Guidance Simulation, VV&A, Database, Resource Modeling, Resource Management.

1 Introduction

In order to implement VV&A tasks successfully, lots of resources are needed, such as test data, experiment data, different categories of documents, pictures and videos. Therefore, a software tool named VV&A Resources Management SYSTEM (VRMS) is designed and developed to support VV&A tasks of GSS. The Structure and functions of VRMS are shown as follows.

2 Categories of VV&A Resources

VV&A resources are produced mainly in the development process of GSS, and the development process of GSS is depicted in figure 1.

As shown in Fig.1, in the “Requirements Phase”, the corresponding VV&A tasks are verification of simulation requirements and generating verification reports, hence the resources in this phase are various requirement documents. In the “Design Phase”, the corresponding VV&A tasks are verifying mathematical models, components scheme, and design reports etc. As a result, the relative resources in this phase mainly include kinds of design specifications or schemes of various models, and the simulation programs to validate the validity of mathematical model are important as well. At last in the “Implement Phase”, the mainly resources are various kinds of test data, experiment data, and relative analysis reports. In addition, for validating the validity of simulation experiment data and simulation model, flight experiment data are also needed. And in order to review simulation experiment process and operate the model, some pictures and videos should be gotten as Fig.1.

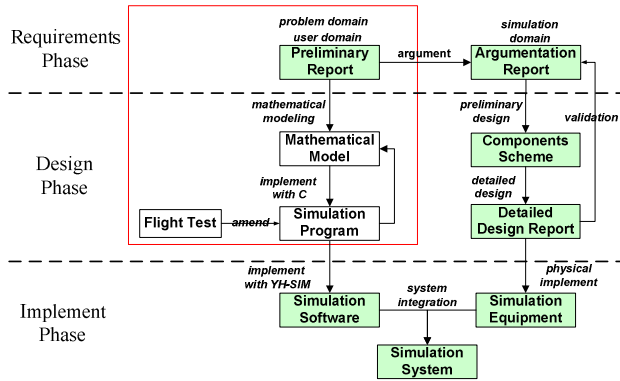


Fig. 1. The development process of GSS

In conclusion, VV&A resources are the set of all valuable products in the whole life-cycle of GSS, which include data, documents, models, pictures, videos and so on.

3 Resources Modeling

There are three reasons for resources modeling: a) Find valuable information from properties of various resources, and establish the data model of it, b) Provide the foundation for data structure and management rules of bottom database, c) Provide the model formwork for different guidance simulation system and improve the reusability of model.

In this paper, the IDEF1X method is used to describe the models of document, mathematical model, data, video and other resources based on the software tool – “ERWin Data Modeler”. The logical model should be gotten firstly, and then transformed to a whole physical model.

Logical Model

Each kind of resource has some different properties, as to document, the properties of which include document title, generating date, author (or organization), abstract, purpose and so on. But not all the properties are concerned by VV&A practicers. Besides, since the sources of different resources are the same with each other, the properties of which must also be same as others or relative with others. Logical Model is a kind of information model which provides a specification to describe the entity and property of resources.

For example, as for mathematical simulation experiment result data, the logical model is depicted in figure 2.

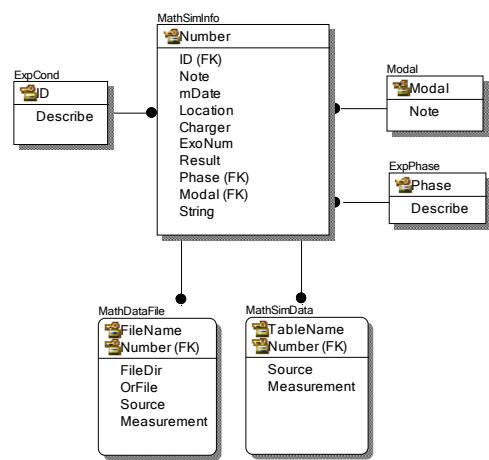


Fig. 2. The logical model of simulation result data

Physical Model

Physical model is usually used to describe the structure of special DBMS, which transforms the entities of logical model to table, and transforms relationships to referential integrity. The physical model is depicted in figure 3.

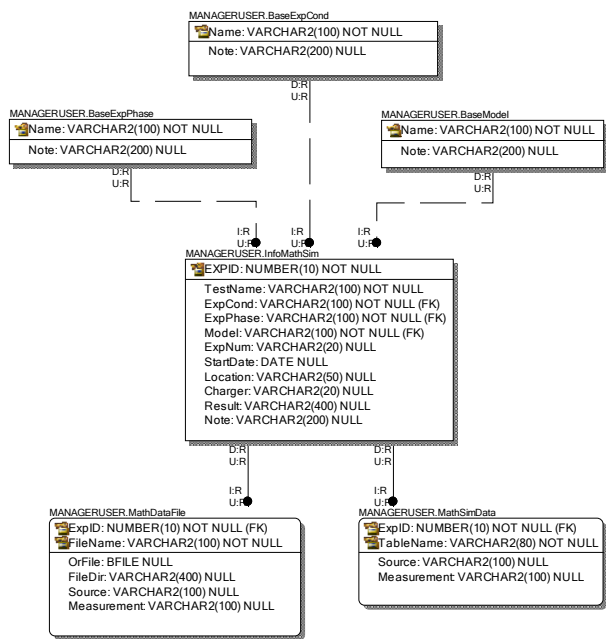


Fig. 3. The physical model of simulation result data

The referential integrity in physical model is depicted in table 1, which is efficient for preventing the exception of data insert, delete, and update operation, and also for improving the security of the data and the database.

Table 1. The referential integrity in physical model

	Insert	Delete	Update
Parent Table	None	Restrict	Cascade
Child Table	Restrict	None	Restrict

In view of ERW tool, the corresponding SQL scripts would be generated based on the physical model mentioned above automatically. It would create tables and relationships between each other in Oracle10g by executing the SQL scripts.

4 Structure of Hardware

Resource management system will work on model of C/S. Its structure of hardware is depicted in figure 4.

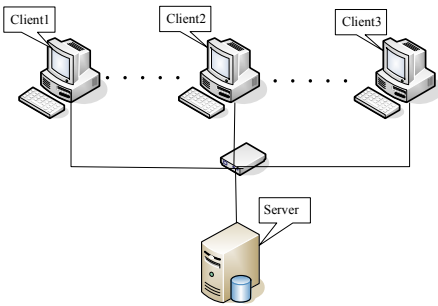


Fig. 4. Structure of hardware for resource management system

5 Functions of Vrms

VRMS functional structure is depicted in figure 5.

It consists of two parts. One is underlying database; the other is resource management platform. Underlying database is used for storing all kinds of resource. Resource management platform provides the powerful tools to realize the function for user.

User&Role Management module: provides function for Authority distribution and Set careful and multi-level access to control strategy.

Test Information Management module: Management mathematical simulation and test, the hardware-in-the-loop simulation and test, the flight test and the data from the test equipment.

Basic Information Management module: Management model, test conditions, the missile test phase, the state and other basic information.

Resource Import/Export module: To provide convenient and rapid resources into output function, the greatest degree of improving resources into automation level.

Resource Query module: To provide the resources single, composite, the fuzzy inquiry, summary display.

Resource Backup module: Backup database table, view, and index of the object backup and restore function, improve the database security.

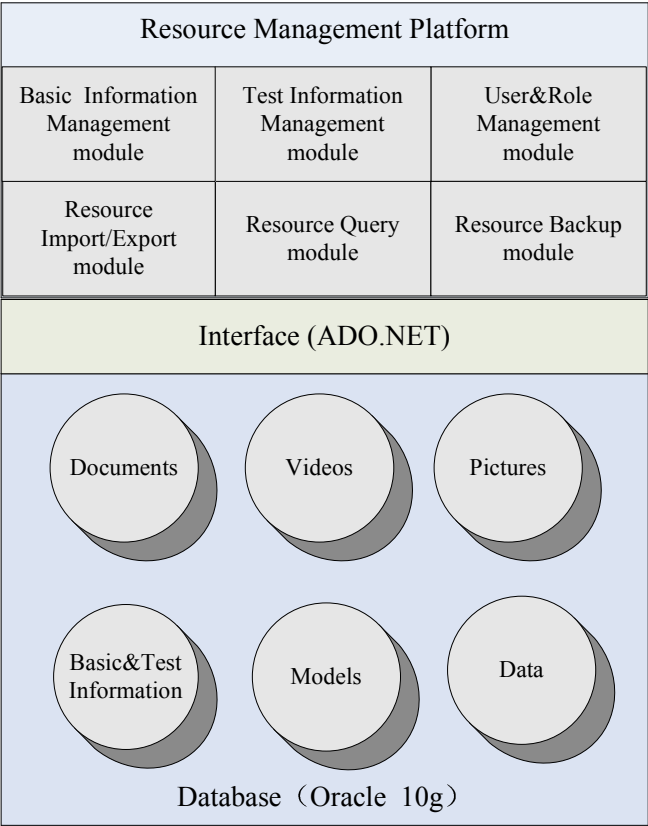


Fig. 5. Resource management system software structure

6 System Realization

In VS 2008 environment development the client application, the ado.net development between the client and the database of the interface between program.

The system finally used in local network. In order to improve the efficiency and safety of data exchange, the management system uses C/S mode.

Management system provides friendly, convenient and interactive platform for related workers and the underlying database interactive.

7 Summary

This paper established the guidance simulation system of VV&A resources logical model and physical model.

It is the one with strong reusability and a general design of reference to all sorts of guidance VV&A simulation system of the resource pool.

On the basis of the development of resources management system function is nearly perfect.

It realizes all kinds of resources and improves the management of resources for all the safety and VV&A automation level.

References

1. DMSO Department of Defense Modeling and Simulation (M&S) Master Plan (DOD 500059-9P October 1995) 1995
2. Sargent, R.G.: Verification and Validation of Simulation Models. In: Proceedings of the 2007 Winter Simulation Conference, pp. 124–137 (2007)
3. Skoutas, D., Simitsis, A.: Ontology-based Conceptual Design of ETL Processes for both Structured and Semi-structured Data. *International Journal on Semantic Web and Information System (IJSWIS)* 4(3), 1–24 (2007)
4. Li, H.-Y., Chen, L.-F., et al.: System Test Database and Its Application in Simulation System. *Computer Simulation* 23(5), 5–9 (2006)
5. Liu, X., Shang, C.-Y.: Database Design and Application for Air Combat Simulation System. *Aeronautical Computing Technique* 36(2), 53–55 (2007)
6. Jiao, P., Tang, J.-B.: Result Validation Tool for Guidance Simulation. In: The International Conference on Computational Intelligence and Software Engineering, pp. 12–14 (2009)
7. MSCO. Documentation of Verification, Validation, and Accreditation (VV&A) For Models and Simulations (MIL-STD-3022) (EB/OL) (September 2008)
8. DMSO. Instruction 5000.61. DoD Modeling and Simulation (M&S) Verification, Validation, and Accreditation (DoD Instruction 5000.61) (EB/OL) (2007), <http://www.dtic.mil/whs/directives/>
9. Cowdale, A.: Lessons Identified From Data Collection For Model Validation. In: Proceedings of the 2006 Winter Simulation Conference, pp. 1280–1285 (2006)